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ABSTRACT

Technology and educational changes force educational systems to modify their infrastructure to offer new teaching services to the learning community. The aim of this research paper is to present an infrastructure from a broader systems perspective that helps educators understand the relationship between a Web educational system and its environment. The outcomes of such an analysis should allow users to assess the impact of the various supra-systems and sub-systems on a Web educational learning environment. The results of this analysis should facilitate the identification of the particular functions of a Web educational system. The analysis of the systems environment, the functions/structure components of the Web educational sub-system, and the processes involved in the transformation of inputs into the intended outputs brought to light the complexity of managing changes in an intricate educational system living in its supra-system (environment). This experience also underscores the necessity to look at change processes as an ongoing endeavor that continually attempts to improve the system's capacity (Web-based model) to adapt its goals to the changes in the environment. (AEF)

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A SYSTEM APPROACH TO MANAGE EDUCATIONAL CHANGE IN A WEB-BASED EDUCATIONAL SETTING
A PROPOSED INFRASTRUCTURE

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Abstract

Technology and educational changes force educational systems to modify their infrastructure to offer new teaching services to the learning community. The aim of this research paper is to present an infrastructure from a broader systems perspective that help educators understand the relationship between a web educational system and its environment. The outcomes of such an analysis should allow the readers of this research paper to assess the impact of the various supra-systems and sub-systems on a web educational learning environment. Furthermore, the results of the analysis should facilitate the identification of the particular functions of a web educational system.

Introduction

Educational institutions like other organizations in our society are faced with ineluctable changes brought on by new communication technologies. Various web educational models are developed and implemented to meet new demands in education and to survive in a highly competitive educational world. According to Salisbury (1996), transformational change can only be achieved when a systems view is applied appropriately to the specific institutional context and the interrelatedness of the various sub-systems is fully understood.

The conceptual frameworks provided by the writings of Salisbury (1996), Banathy (1992), and Moore and Kearsley (1996) allow the author of this article to examine a web-based educational setting from a systems point of view. The aim of this paper is to present a conceptual infrastructure, using a system approach, to describe the components of a web educational system that are affected by changes in the environment such as technology.

Educational Environment as a Supra-System

In education, the concept supra-system could be defined as an integrated framework that includes all the different education bodies and agencies seen as sub-systems. A system is an integrated entity that is focused on a set of objectives. Most systems accept inputs and transform them into outputs. The different sub-systems of a larger system can be perceived as environments with distinctive boundaries and at the same time multiple interrelationships. Each sub-system can be viewed as part of several supra-systems such as educational, technological, and economic, namely. Figure 1 shows the relationship between a web-based educational sub-system and the supra-system.

A closer look at a web-based educational environment reveals its elements generally identified as learners, instructional resources, behavioral objectives, goals of instruction, etc. (Salisbury, 1996). These new web educational system must present a system of instruction that provides for easy registration, access to relevant content, and the means to self-assess one's progress. This is accomplished primarily as the result of the Internet communication tools.

Figure 1 A Web-Based Educational Setting and the Supra-system

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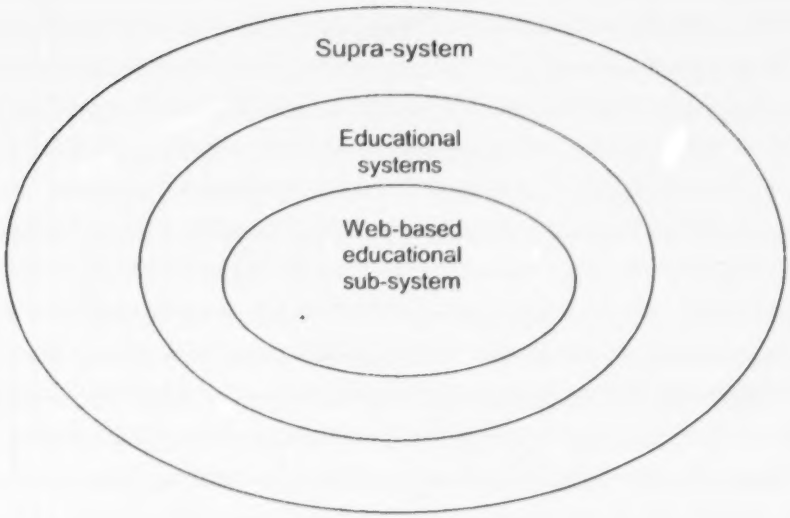
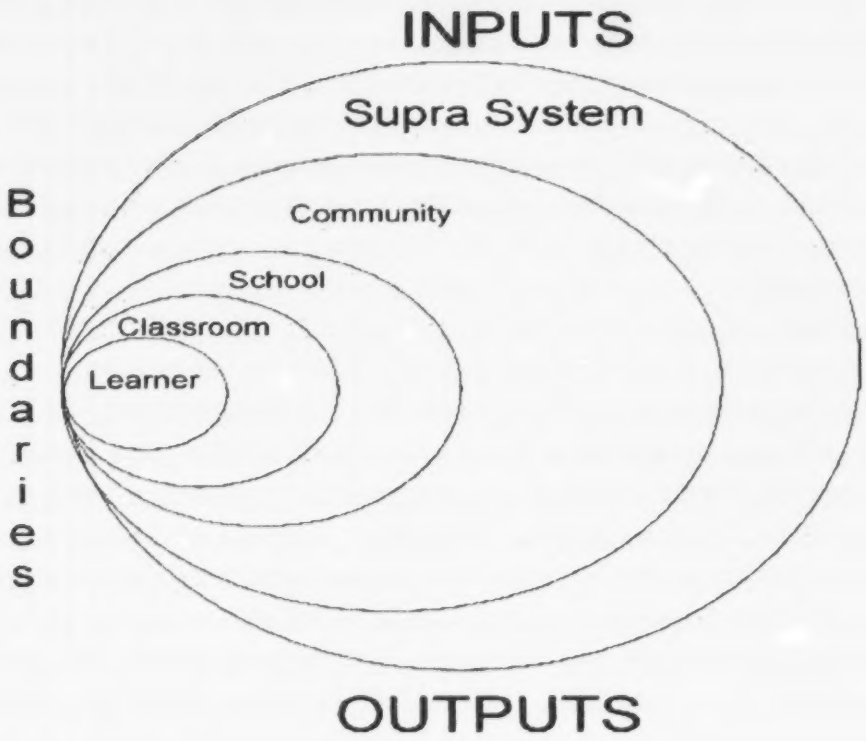


The emergence of these new technologies has forced many teachers to review their traditional perceptions of their roles in the teaching process and to engage themselves in a learning process that addresses the gap between their actual and expected technological competence. The fact that this gap also exists within society in general is another reason why educational organizations need to address this problem and enable their students to better cope with this new reality. Traditionally, educational institutions have seen themselves as a relatively closed environment. However, by analyzing how business organizations have reacted to changes within the supra-system, they have created inter-organizational systems to be able to survive and grow in a highly competitive environment.

Systemic Environment and Systems Boundaries

Figure 1 illustrates the relationship between the supra-system and its components, the sub-systems: learning community, schools system, classroom, and the learner. Figure 1 tries to represent the embeddedness of the learner within his/her educational environment. This diagram helps the web learning system designer to understand which components have to be taken into consideration if the web educational system is going to reach its intended goals.

Figure 1 The interfaces in an educational setting and its relationship with the Educational Supra-system



When assessing the design of a web teaching system, the owner of the system has to determine whether the educational model has actually attained the goals it set out to reach. The system and its environment are separated by permeable boundaries. Inputs enter in the system through breaks on the boundaries and are then transformed into outputs. Another important aspect is the capacity of the system to adapt to change, i.e. to transform feedback from all stakeholders into the appropriate adjustments to the system itself.

The first consideration in the analysis of the various inputs from the educational environment is how the mission and goals of the organization are related to the instructional delivery. The mission should be closely aligned with the goals of the web-based educational system. The Functions/Structure lens (Banathy, 1992) allows to see the educational system at a given moment in time. It is a snapshot of what is happening in an educational program. Did the educational system, for example, begin with a careful formulation of the goals and missions of education and then work backwards from there to create alternative visions of systems that might be designed to perform the functions necessary to accomplish that purpose (Salisbury, 1996)?

The rising popularity of the Internet forces traditional educational institutions to offer new services to educators and learners. Rising education costs, emerging opportunities for new revenues for colleges and universities, and better services to students will compel these institutions to adopt an e-business strategy (Katz and Oblinger, 2000). Virtual and modern educational settings will emerge in this educational network infrastructure where educators and learners will expect a better educational product from the supra-system. Colleges and universities will have to reengineer their educational processes to adapt to new learners demands. Culture and change could be important factors to manage properly in order to assure educational growth in the

supra-system. They are more complicated to implement than technology. E-business technologies and media will provide improved and expedited benefits, increased process efficiencies, and competitive training to lifelong learning.

According to Moore and Kearsley (1996), typical components that constitute inputs in a web education system are students' characteristics, students' access to resources, response time, and institutional cooperation and support, etc. Instructional design should therefore start out with a thorough needs analysis of the potential learners, provide access to the appropriate technologies, and continually update the content and technologies used to deliver the instructional materials to the learners. In her book on creating a virtual classroom, Porter (1997) outlines criteria for determining the effect of instructional design and the kind of processes needed to make sure that inputs will result in effective outputs. For example, student characteristics, computer interaction, learning style, involvement, and participation should be part of the inputs the design team would have to consider before determining the instructional strategies of the educational program.

From a systems view, outputs can be viewed as functions of the system that achieve their purpose. Evidence of output functions that correlate with the statement of the intended learning goals will be investigated in order to determine whether the outputs actually relate to the inputs. Moore and Kearsley (1996) list several 'output' components in education systems that provide valuable information of the overall effectiveness of the system, e.g. student satisfaction ratings, student achievement scores, and completion rates. The question that the stakeholders of the educational system should ask: is the web-based educational system doing what it was intended to do? The learning should be structured in such a way that it delivers skill-based instruction in various processes to enhance learning outcomes.

Training programs and professional programs are essential to help teachers learn basic skills necessary to develop sound and effective web-based teaching systems (St-Pierre, 1999). If the educational organization realizes that, after all, the training participants do not put into practice the skills introduced in the training program, there should be an adjustment or adaptation in the system process with respect to the originally intended skills or knowledge (Salisbury, 1996). A thorough evaluation of output, i.e. what results from the transformation of input during the learning process, is obviously important to determine the overall effect of the training. The development of the appropriate strategies and tools to close the gaps between the current performance level of the training participant and the expected performance level should be the major focus in the development of any training necessary to promote learning outcomes in a web educational setting (Brethower, 1995).

The stakeholders of a web-based educational system, living in a supra-system, must identify instructional inputs and outputs from a traditional teaching perspective to transform them into a modern web teaching setting where new technology can help to design new instructional tools and media to promote learning outcomes. While the selection of new media allows for some learner control and also takes learner motivation into account, the instructional design has to expand outside its established boundaries and exploit deeper situational learning concepts that could be developed from a wider systems view. For example, a collaborative virtual learning community could be created through its web-based educational system to exchange ideas, knowledge and teaching products with its environment. St-Pierre, Bettin, Dillinger, and Ferraro (1999) present in their paper the components that an integrated community learning system should have while offering educational services to learners on the Internet.

Functions/Structure Analysis for a Web-Educational Sub-system

The main goal of this section is to describe briefly the functions/structure model for a web educational system as shown in Figure 3. This web educational system includes at least six main functions that are integrated to help educators develop web instructional models to promote learning outcomes.

Web Registration Function

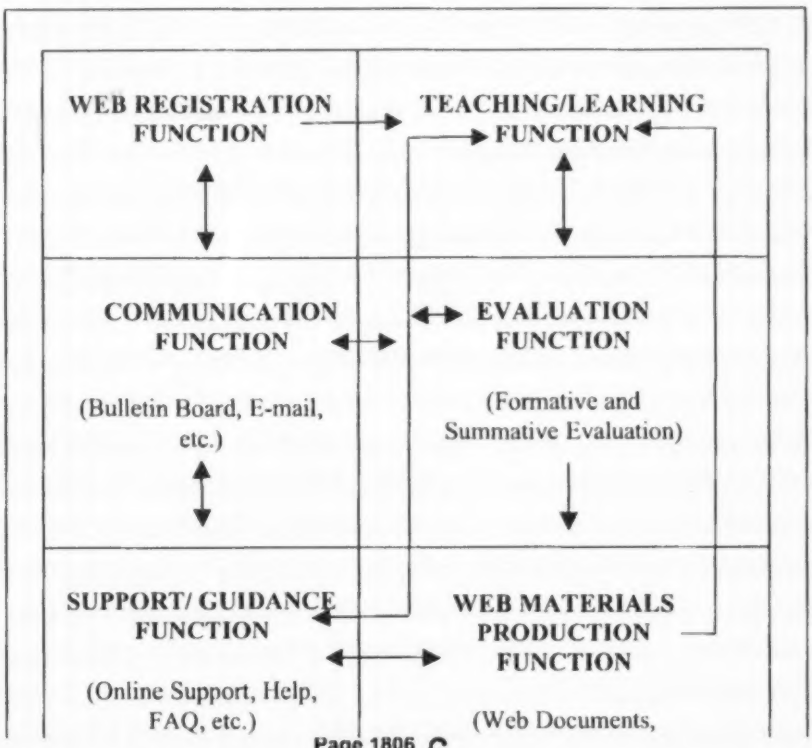
Anyone who intends to take a course has to register by filling out a web-based registration form. The data entered in the registration function are processed through CGI-technology specifications and recorded into a database. The sub-system will produce a form displaying the UserID and the password required for accessing the teaching/learning component of the educational sub-system. There is a direct relationship between the registration and the teaching/learning components of the web educational system.

Teaching/Learning Function

The teaching/learning function includes learning modules that the student can choose from. The web learning modules, divided into numerous short lessons, provide contents that help the participants acquire the basic knowledge and develop technical skills. After having completed the learning modules, the participants may use the communication media to correspond with tutors and other participants or move on to the evaluation function. There is a direct relationship between the communication process and the teaching/learning function.

When computers are connected through the Internet, web media provide appropriate means for communicating and delivering instructional materials (Zellner, 1997). Well-designed web-based instruction provides an efficient delivery medium for the instructor and attractive course content delivery for the students in the classroom (St-Pierre, 1999). In addition, mediated forms of delivery using the web make it easy to update dynamic, constantly changing information; a very important aspect for a course that introduces to rapidly changing web.

Figure 3 Functions/Structure Model for a Web educational Sub-system



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Evaluation Function

Within each lesson, the learners have the opportunity to complete the so-called "Try it" exercises. They have to use basic concepts, knowledge, and skills acquired from the teaching/learning function to be able to solve problems presented in these exercises. The participants can work on these exercises on-line or off-line. The evaluation function will monitor the lessons and exercises throughout the teaching process at different points in time. Every time the participants return to the web educational learning model, the Lesson Status page could display a report showing their progress and suggests which lessons to work on next. Also, at the end of each lesson, the participants may complete an evaluation form if they wish to give feedback to the teacher on the course content or other topics of concern to them. There is a direct relationship between the teaching/learning function and the evaluation function.

Communication Function

During the learning process, the participants can use web media such as E-mail and the bulletin board to communicate in an asynchronous manner with other participants. At any time during the learning process, the participants can create a conference room with the tutors to obtain explanations on concepts or skills presented in the teaching modules. There is a direct relationship between the communication function and the major components of the web educational system, such as web registration, teaching, evaluation, and support functions.

Support Function

The participant can click on the Help icon to access a list of FAQ that will answer questions about online procedures, navigational cues, or curriculum issues. Also, the participant may send an E-mail message to a tutor and will (allegedly) receive a quick response within 48 hours. There is a direct relationship between the support function and the teaching/learning function.

Web Materials Production Function

The teaching/learning model uses a web platform to deliver curriculum and instruction. This platform is easy to maintain and can be accessed by a large population of educators and learners.

The participant can display and/or print the web training contents in an HTML or Adobe format. There is a direct relationship between the web materials production and the teaching/learning function.

In conclusion, the analysis of the different functions of the web educational sub-system show that these functions are indeed all interrelated as suggested in Banathy's Functions/Structure model. The web instructional teaching system has to be well designed from a technical point of view and present good design features (interface design, navigation, progress report, etc.) to motivate the potential participant to register and engage into an effective learning process.

Conclusion

The analysis of the systems environment, the functions/structure components of the web educational sub-system, and the processes involved in the transformation of inputs into the intended outputs brought to light the complexity of managing changes in a intricate educational system living in its supra-system (environment). This experience also underscores the necessity to look at change processes as an ongoing endeavor that continually attempts to improve the system's capacity (web-based model) to adapt its goals to the changes in the environment.

The continuous progress of technology will have direct consequences on the educational setting that will have to be revised repeatedly. In addition, new teacher generations will no longer need basic Internet training because they will have already used the web extensively at home and in school. In addition, effective feedback systems should be implemented in educational settings to provide relevant information for the necessary adjustments of the system. Furthermore, educational changes should take place on a continuous basis to develop a competitive educational system in an open educational supra-system where major technological changes threats its survival.

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